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ABSTRACT

In 1989, a research project was initiated at Sacramento City College (SCC) to conduct a retrospective analysis of a sample of 400 continuing and entering students enrolled at SCC during fall 1987. The purpose of the study was to examine the relationship between academic success, basic skills assessment test scores and recommended placement levels, and demographic and educational background variables. The students were followed from fall 1987 through spring 1989, and their academic success was measured in terms of their cumulative grade point average (GPA) and the number of semesters they persisted as students at SCC over the two-year period. Selected findings included the following: (1) age was a significant predictor of cumulative GPA, but not of scores on the Stanford Test of Academic Skills (TASK) English or reading tests; (2) being female was a significant predictor of higher English test scores; (3) being a non-native English speaker was a strongly significant predictor of lower English and reading scores on the TASK; (4) English and reading scores varied significantly between ethnic groups, as did cumulative GPA and persistence; (5) English and math course levels completed were significant predictors of English and reading scores and of cumulative GPA; (6) English course level also positively predicted persistence; (7) college units (or degrees) previously completed were significant predictors of cumulative GPA, but not of assessed scores; and (8) TASK English and reading test scores and recommended placement levels were significant predictors of cumulative GPA, but not of persistence. This document consists of two separate papers: an Executive Summary and the complete Final Report. (JMC)

ED346941

ASSESSMENT RESEARCH PROJECT

The Relationship of Academic Success to Basic Skills, Educational Background, and Demographic Characteristics: A Retrospective Study of Sacramento City College Students

Prepared by

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SACRAMENTO CITY COLLEGE
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ASSESSMENT RESEARCH PROJECT

EXECUTIVE SUMMARY

The Relationship of Academic Success to Basic Skills, Educational Background, and Demographic Characteristics: A Retrospective Study of Sacramento City College Students

Introduction

Like all public community colleges in California, Sacramento City College (SCC) is an "open access" institution, meaning that anyone eighteen years and older can register as a student regardless of his or her previous academic preparation or performance. As a result, SCC admits a highly diverse group of students, many of whom need to improve their basic skills in writing, reading, and mathematics before taking college-level courses. In attempting to address these issues and to increase student success and retention, SCC and many other community colleges are making basic skills assessment and instruction a major mission in addition to the more traditional ones of preparing students to transfer to four-year colleges and providing vocational training in associate degree and certificate programs.

The SCC Assessment Center opened in Fall 1980 to provide assessment services to students on a voluntary basis. In 1986, the Assessment Center began the institutional Program Review process. In the same year, the Seymour-Campbell Matriculation Act, which mandates assessment and advisement to insure proper student placement, was passed by the California Legislature. Along with concerns voiced by SCC staff and students, these developments created the need to evaluate SCC's assessment practices and analyze the relationships between student demographics, assessment scores, and academic success.

In 1987, the Office of Planning, Research and Development (OPRD) was established at SCC to conduct institutional research efforts. A comprehensive baseline assessment research proposal was developed by OPRD and the Assessment Center with input from the Matriculation Assessment Subcommittee and approved for funding by the Program Review Committee in 1989. This research project was then initiated to conduct a retrospective analysis of a 10% sample of continuing and entering students enrolled at SCC during Fall 1987 (N = 1,381) to examine the relationship between academic success, basic skills assessment test scores and recommended placement levels, and demographic and educational background variables. The students were followed from Fall 1987 through Spring 1989, and their academic success was measured in terms of their cumulative GPA and the number of semesters they persisted as a student at SCC over the two-year period.

Research Questions and Methods

The major research questions addressed by this project are:

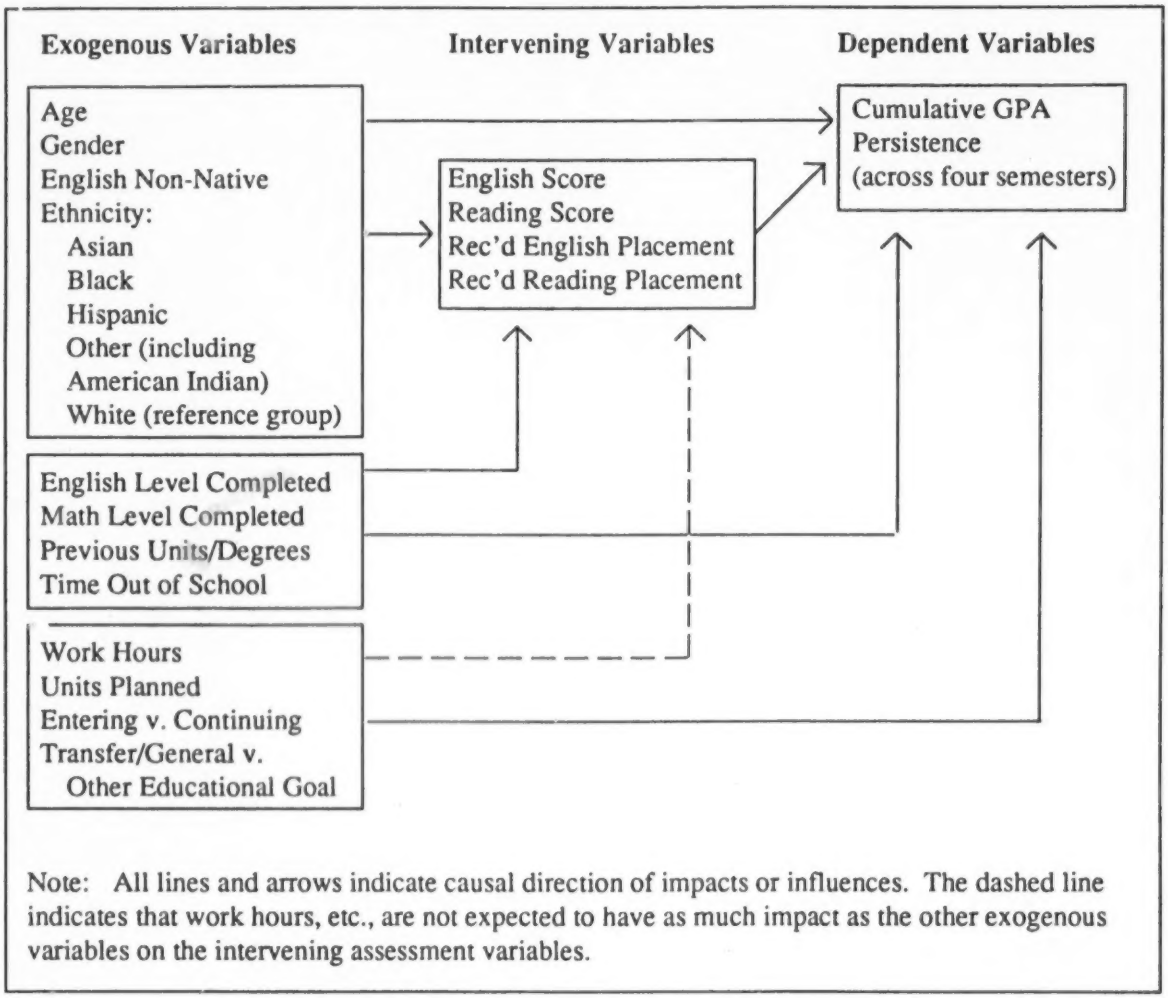
1) What, if any, are the effects of students' demographic and educational background characteristics on their academic success?

2) Are students' basic skills assessment results significantly related to (i.e., good "predictors" of) their academic success, controlling for their demographic and educational background characteristics?

Multiple regression techniques were employed to test a causal model (page 3) which treats demographic and educational background characteristics as exogenous independent variables, assessment test scores and basic skills course placement levels as intervening variables, and cumulative GPA and persistence as dependent or outcome variables.

Of the 1,381 students in the original 10% sample, 585 had assessment records, and 400 who had data available on all variables were included in the multiple regression analysis. Ethnicity was coded into five categories, and white students--as the largest ethnic group--were used as a reference group, meaning that the other four groups were compared to whites to check for statistically significant differences. Math scores and placement levels could not be included in this study because too few students in the Fall 1987 sample were assessed for math skills to use these variables in the statistical analysis.

The Causal Model



Note: All lines and arrows indicate causal direction of impacts or influences. The dashed line indicates that work hours, etc., are not expected to have as much impact as the other exogenous variables on the intervening assessment variables.

Findings

Based on the statistical results of the multiple regression analysis (reported in depth in the full report), the following conclusions can be made about the variables in the study. It is important to note that the impacts of each variable described below hold true regardless of the category or value of the other variables because multiple regression controls for such variation.

- AGE

  Age is a significant predictor of cumulative GPA but not of scores on the Stanford Test of Academic Skills (TASK) English or reading tests. Older students, on average, have higher GPA's.

- GENDER

  Being female is a significant predictor of higher English test scores. Gender does not appear to be significantly associated with reading score, cumulative GPA, or persistence.

- ENGLISH NON-NATIVE

  Being a non-native English speaker is a strongly significant predictor of lower English and reading scores on the TASK. (Many of the English non-native students who took the TASK tests are probably from bilingual families where another language is predominantly spoken at home.) There is no significant difference between being an English non-native and cumulative GPA or persistence.

- ETHNICITY

  English and reading scores vary significantly between ethnic groups. Asian students, on average, score significantly lower on the reading test than white students, but there is no significant difference between their English scores. Black students and students in the "other" ethnic category, on average, score significantly lower than white students on the English and reading tests. There are no significant differences, on average, between Hispanic students' and white students' English or reading scores (although based on the above findings for the English non-native variable, Hispanics who are non-native English speakers score significantly lower than those who are native English speakers).

  Cumulative GPA and persistence vary significantly between ethnic groups. Black students as a whole have significantly lower average GPA than white students, but black students whose English and reading scores are comparable to those of white students do not have a significantly different GPA. The average GPA of Asian students as a whole is not significantly different from that of white students, but Asian students whose English

and reading scores are comparable to those of white students have a significantly higher GPA. Asian students as a whole have a significantly higher persistence rate than white students. There are no significant differences between the average cumulative GPA or persistence rate of Hispanic or "Other" students and those of white students.

- ENGLISH LEVEL COMPLETED and MATH LEVEL COMPLETED

  English and math course levels completed are significant predictors of English and reading scores and of cumulative GPA. English course level also positively predicts persistence. For example, students who have completed high school college prep English prior to enrolling at SCC score significantly higher on the English and reading tests and, in turn, have a significantly higher cumulative GPA and persistence rate than students who have completed only high school basic skills or regular English courses.

- PREVIOUS UNITS/DEGREES and TIME OUT OF SCHOOL

  College units (or degrees) previously completed is a significant predictor of cumulative GPA but not of assessment scores. Time out of school is not significantly associated with assessment scores or the student success measures. (This may be due to limitations in the way it is measured).

- WORK HOURS and UNITS PLANNED

  Students' employment hours and units planned are not significantly associated with assessment scores or student success. (This could be due to limitations in the research design.)

- ENTERING V. CONTINUING STATUS and TRANSFER/GENERAL V. OTHER EDUCATIONAL GOAL

  English scores on the TASK were significantly higher for the Fall 1987 entering student cohort than for Fall 1987 continuing students at the time they were tested. However, the average cumulative GPA of entering students is lower than that of continuing students. There are no significant differences between assessment scores and student success measures for students with transfer or general educational goals and those for students with other (primarily vocational and job skill) educational goals.

- ENGLISH AND READING SCORES (and RECOMMENDED PLACEMENT LEVELS)

  TASK English and reading test scores and recommended placement levels are significant predictors of cumulative GPA but not of persistence. English and reading scores are very highly correlated with each other.

Discussion

There are several practical implications for institutional policies and practices which can be drawn from the findings presented above. Matriculation regulations require community colleges to evaluate how well assessment instruments and other assessment and placement criteria predict success in basic skill and discipline-specific courses. Several variables included in this study are significant predictors of student success and can be used as multiple criteria for assessment and counseling/advisement or otherwise taken into account by SCC staff.

Because they are highly correlated with each other, TASK English and reading scores should be utilized together as one assessment and placement criterion. Although recommended placement levels based on current cut-off scores work about as well as raw test scores for predicting cumulative GPA, they still need to be validated by the college as predictors of success in writing and reading courses. When there are major discrepancies between students' English and reading test scores, students should meet individually with a counselor for a more in-depth discussion and evaluation.

Previous English and math course levels completed can serve as multiple criteria along with assessment test scores or recommended placement levels. In addition to these two educational background variables, high school GPA, grade in last English class and grade in last math class, which are available from the Computerized Assessment and Placement Program (CAPP) database, should also be examined as other possible assessment and placement criteria. Perhaps high school transcripts should be obtained to confirm the reliability of students' self-reports on the CAPP form. Beginning in Fall 1988, many more students at SCC were tested for math skills, and math scores and recommended math placement levels should also be examined as possible multiple assessment and placement criteria, particulary for math courses.

Although age is not a significant predictor of students' performance on the TASK assessment tests for writing and reading skills, it is a significant predictor of success as measured by GPA. This implies that older students may have experience, skills and motivation that younger students may not have but which are not adequately measured by the assessment instrument. Therefore, students' age may be useful to take into account along with the factors identified above.

Previous college units/degrees positively predicts general student success as measured by cumulative GPA, but this variable is currently used as a matriculation exemption criterion at SCC. As such, it would not be relevant as one of the college's multiple criteria, except for matriculation-exempt students who voluntarily choose to be assessed.

Even controlling statistically for all the other variables included in this study, there are significant differences between specific ethnic groups in terms of their average assessment test scores, cumulative GPA's, and persistence rates. Until the TASK and other tests are carefully evaluated for cultural and linguistic bias and approved by the CCC Chancellor's Office as meeting minimal standards in this regard, there is no way to know how much the differences in test scores between

ethnic groups reported in the findings are due to test bias and how much they are due to differences in basic skills in English, learning and study skills, academic motivation, or socio-economic factors not accounted for in this study. Community college educators need to bring pressure to bear on test developers to do their part in this evaluation. In the meantime, careful test orientation for students by the Assessment Center staff as well as multiple criteria assessment within the counseling process can countervail possible cultural, linguistic, or other biases in the assessment instrument.

A fair number of Fall 1987 students who said English was not their native language (N = 133) took the TASK writing and reading tests, and they scored significantly lower, on average, on these tests. This may indicate that ESL testing and placement in ESL courses would be more appropriate for some of these students, but it may also indicate that a fair number of bilingual students who speak predominantly another language in their homes need basic skills instruction in English and reading. Currently, students who score low on the TASK and indicate that English is not their native language are directed to take the ESL test. Bilingual students should also receive individual placement counseling which takes other criteria and factors into account.

Students' responses to the questions on the assessment form which ask about their employment hours and college units planned are most likely specific to the time at which they were assessed and the school term immediately ahead of them. The work hours and college units which students plan for themselves are very likely to change over time, and even if they did not, the relationship between these factors and their cumulative GPA is very likely to attenuate as the number of semesters over which their cumulative GPA is measured increases. It is more likely that a relationship would be found between Fall 1987 entering students' work hours or units planned and their Fall 1987 GPA's than their cumulative GPA's. This semester-specific measure of student success should be examined in subsequent work on this project or future research projects at SCC.

Based on the findings, entering students must be considered a more "at risk" group than continuing students regardless of their assessment test scores. Motivation, self-discipline, and learning/study skills, as well as basic skills preparation, can strongly influence students' academic survival and success. SCC can enhance all these factors through appropriate student services and instructional interventions, such as the Early Start Program (ESP), Educational Opportunity Programs and Services (EOPS), "College Success" extended orientation course, the Higher Education Learning Package (HELP), and the Puente Project, whereas many of the demographic and educational background variables in this study are outside of the college's immediate control to address.

Persistence was not significantly related to the demographic, educational background, or basic skills assessment variables, with the few exceptions noted in the above findings. Persistence may not be a very useful or valid measure of student success without taking educational goal, student classification, and other factors into account. Students who enter SCC with a large number of college units or previous degrees may attain their educational goal well within the four semester period for which persistence was measured in this study, especially if they are attending primarily

to obtain or upgrade specific job skills. In addition, many students with job and family responsibilities may purposely attend SCC on an intermittent as well as a part-time basis.

Suggestions for Further Research

Although this study was initially undertaken as part of the Assessment Center's on-going institutional program review process, it also provides pre-matriculation "baseline" data and statistical results for SCC's overall Matriculation Research and Evaluation Plan and especially for the Assessment component, which has received so much emphasis from the Chancellor's Office and in the Matriculation Regulations adopted by the Board of Governors of the California Community College system. The Matriculation Regulations which become effective July 6, 1990, require community colleges to utilize valid and reliable multiple criteria for assessment and placement and to "determine whether any assessment instrument, method or procedure has a disproportionate impact on particular groups of students described in term of ethnicity, gender, age, or disability, as defined by the Chancellor" (Section 55512 [b]).

Based on an exploratory study of six California community colleges which addressed the issue of whether assessment and placement practices pose barriers to access for underrepresented minorities, Kanter (1990) concluded that "emphasis should be placed on assisting underrepresented students to become eligible in greater numbers for the transfer/baccalaureate level of community college courses. If socioeconomic or income rather than ethnicity data had been available for this study, it is likely that these variables would have emerged as the strongest predictors" of placement at the precollegiate basic skills, associate degree applicable or transfer/baccalaureate level. Further SCC research on predictors of students' basic skills and academic success should include income and other socio-economic variables if it is possible to obtain data for them.

The greatest need for further assessment research at SCC at this time is to develop a database with adequate course-level sample sizes to permit evaluation of the relationship between demographic and educational background characteristics, assessment test scores and recommended placement levels, and course-specific success measures (grades and successful completion) for both basic skill and content courses. At the college level, this requires working back from course enrollment lists to admissions and assessment records and forward to transcripts for end-of-semester grades. The sampling design should include students who enroll in the selected courses not more than two semesters after they enter the college and are assessed for basic skills. One study design that uses this approach is Design 6, "History Course Success Based on English Eligibility," Matriculations Local Research Options Project (Spicer, 1989). By adding additional student demographic and educational background data and elaborating the design to include a range of courses across the college curriculum rather than one particular course, such a study would address a number of Matriculation research and evaluation issues and aid in validating pre- and co-requisites for college courses, as required by Title V regulations.

Perhaps the most important study to date along these lines involved a consortium of southern California colleges headed by a team of researchers at Santa Barbara City College (Cohen, et. al., 1989). They found the following variables to be the most common best predictors of students' grades across a fairly large number of college courses: English test score, reading test score, math test score (or math level), high school GPA, age, units planned, number of hours employed, and high school graduation status. As is noted in the report, "Colleges need to identify their own set of predictor variables based on information they collect from students" (p. 15). The Assessment Center has been gathering data on these and other variables with the new CAPP system since December 1988, and this will allow the Office of Planning, Research and Development to identify SCC's own set of best predictors of student success.

In addition to investigating students' basic skills in writing, reading, and math as measured by assessment test scores, research on predictors of student success should take students' motivation and study skills into account. Kochenderfer (1988) conducted an exemplary study at Riverside Community College to examine the effect of these factors on academic success. Using multiple regression techniques, she found that Learning and Study Strategies Inventory (LASSI) scores (on all ten sub-scales) explained more of the variation in student success as measured by GPA than did basic skills test scores. Further, the LASSI motivation scale accounted for more variation in GPA than the other scales combined. Kochenderfer notes, "The study indicates that the addition of a learning and study strategies measure to the community college entrance examination could more than double the predictive validity of the assessment." The Counseling Division may wish to incorporate use of the LASSI into SCC's matriculation assessment process on a pilot basis and add LASSI scores to the CAPP system. Research could then be conducted to evaluate the LASSI's predictive validity as another criterion for assessment and placement purposes.

The ultimate purpose of this study and all future research on assessment and student success is to provide information regarding the effectiveness of SCC's on-going efforts to increase the prospects of success for its highly diverse student population. By identifying factors which contribute to students' academic success as well as those which may put them at risk of non-success, institutional research can contribute substantially to the college's mission of making open access the "right to succeed" for every student who attends.

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Glossary

CAPP: Computerized Assessment and Placement Program, a software package that was originally developed at Santa Barbara Community College. This program produces the test results print-outs which are received by SCC students and appear on Counselor computer screens.

Cumulative GPA: Cumulative Grade Point Average on students' transcripts, one of the two dependent variables examined in this study. For continuing and re-entry students, this measure would include course work from semesters previous to Fall 1987, as well as for all semesters attended from Fall 1987 through Spring 1989.

Dependent Variable: A measured variable that is the consequence of or is dependent upon antecedent (independent) variables; also referred to as the outcome variable.

English Level Completed: Highest level English course completed, ranging from high school basic skills to college-level English, as self-reported on the assessment questionnaire.

English Non-Native: A student who reported on the assessment questionnaire that English is not his or her native language.

Exogenous Variable: An antecedent or independent variable that is not determined or influenced by any other variables in the research design but which may have a measurable effect on intervening and dependent variables.

Intervening Variable: A variable which is partially the consequence of or is affected by exogenous variables and which in turn may have a measurable effect on the dependent variable.

Math Level Completed: Highest level math course completed, ranging from basic math to calculus, as self-reported on the assessment questionnaire.

Multiple Criteria: Matriculation Regulations require California community colleges to use two or more assessment instruments, methods, or procedures which are used for recommended course placement, referral to appropriate services, or subsequent evaluation. These can include interviews, standardized tests, holistic scoring processes, attitude surveys, vocational or career aptitude and interest inventories, high school or college transcripts, specialized certificates or licenses, educational histories and other measures of performance. In the case of assessment instruments, the use of two or more highly correlated instruments does not satisfy the requirements for use of multiple measures.

Persistence: One of the two dependent variables examined in this study, measured as the number of semesters (not including summer sessions) that students were enrolled from Fall 1987 through Spring 1989.

TASK: Stanford Test of Academic Skills, a basic English, reading, and math assessment instrument used as part of SCC's multiple criteria assessment process for determining appropriate recommended placement in English writing and reading courses.

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FINAL REPORT

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SACRAMENTO CITY COLLEGE
ASSESSMENT RESEARCH PROJECT

FINAL REPORT

The Relationship of Academic Success to Basic Skills, Educational Background, and Demographic Characteristics: A Retrospective Study of Sacramento City College Students

Introduction

Like all public community colleges in California, Sacramento City College (SCC) is an "open access" institution, meaning that anyone eighteen years and older can register as a student regardless of his or her previous academic preparation or performance. As a result, SCC admits a highly diverse group of students, many of whom need to improve their basic skills in writing, reading, and mathematics before taking college-level courses. In attempting to address these issues and to increase student success and retention, SCC and many other community colleges are making basic skills assessment and instruction a major mission in addition to the more traditional ones of preparing students to transfer to four-year colleges and providing vocational training in associate degree and certificate programs.

The SCC Assessment Center opened in Fall 1980 to provide assessment services to students on a voluntary basis. In 1986, the Assessment Center began the institutional Program Review process. In the same year, the Seymour-Campbell Matriculation Act, which mandates assessment and advisement to insure proper student placement, was passed by the California Legislature. Along with concerns voiced by SCC staff and students, these developments created the need to evaluate SCC's assessment practices and analyze the relationships between student demographics, assessment scores, and academic success.

In 1987, the Office of Planning, Research and Development (OPRD) was established at SCC to conduct institutional research efforts. A comprehensive baseline assessment research proposal was developed by OPRD and the Assessment Center with input from the Matriculation Assessment Subcommittee and approved for funding by the Program Review Committee in 1989. This research project was then initiated to conduct a retrospective analysis of a 10% sample of continuing and entering students enrolled at SCC during Fall 1987 (N = 1,381) to examine the relationship between academic success, basic skills assessment test scores and recommended placement levels, and demographic and educational background variables. The students were followed from Fall 1987 through Spring 1989, and their academic success was measured in terms of their cumulative GPA and the number of semesters they persisted as a student at SCC over the two-year period.

The major research questions addressed by this project are:

1) What, if any, are the direct and indirect effects of students' demographic and educational background characteristics on their academic success?

2) Are students' basic skills assessment results significantly related to (i.e., good "predictors" of) their academic success, controlling for their demographic and educational background characteristics?

The answers to these questions are based on the results of the statistical analysis of the study data which are reported in a subsequent section of this report. These answers should provide at least a preliminary basis for better defining which educational background characteristics may serve as valid and reliable multiple criteria for advising and placing students in basic skills and content courses. More generally, the study findings should allow the college to more accurately identify students who are at greater risk of not succeeding academically and to more closely monitor and support their performance through follow-up and intervention strategies.

Methods and Procedures

The Data

The data for this research project are derived from SCC records for a 10% random sample of students enrolled as of the 4th week of Fall Semester, 1987. The data include variables from student admission applications, assessment test forms and questionnaires, and transcripts. Transcript records were used to follow students over four semesters (Fall 1987 through Spring 1989). Because assessment testing was strictly on a voluntary basis as of Fall 1987, only 585 (42.4%) of the students in the original 10% sample had assessment records. All of the statistical analyses involved in this project focus on a smaller sub-sample of students (N=400) for whom data are available on all the variables listed below. Math scores and placement levels could not be included in this study because too few students in the Fall 1987 sample were assessed for math skills to use these variables in the statistical analysis.

It should be noted that the list of variables used in this study represent observations from several different points in time, so this is not a cross-sectional study in the strict sense of the word. This feature of the data will need to be considered carefully when drawing substantive conclusions from the statistical results.

All the data referred to above were collected and combined in a database file in 1989. They were then translated to an SPSS-PC system file, where some of the variables listed below were created with Recode and Compute/If commands. The data were checked for entry errors, and missing values and value labels were assigned.

The Variables

Exogenous Variables - Demographic:

AGE	Years of age.
GENDER	Female = 1, male = 0.
ESL	English is second language = 1, English is native language = 0.
Ethnicity	Coded into five dummy variables (1 if member of ethnic group, 0 if not): ASIAN (including Filipinos and Pacific islanders) BLACK HISPANIC OTHER (American Indian, Alaskan native, or other ethnicity) WHITE (serves as the reference group).

Exogenous Variables - Educational Background:

ENGLEVEL	Highest level English completed (prior to assessment test), on a scale of 1 (high school basic skills) to 5 (college-level English).
MATHLVL	Highest level math completed (prior to assessment test), on a scale of 1 (basic math) to 6 (calculus).
PREVUNIT	Previous college units/degrees completed (at time of application for admission or re-admission) on a scale of 1 (none) to 8 (bachelor's degree or higher).
OUTOFSCH	How long out of school (at time of assessment test), where 1 = recent graduate (1 year or less), 2 = 2 or 3 years, and 3 = 4 or more years.
WORKRHS	Employment hours planned (at time of assessment test), on a scale of 1 (none) to 4 (31 or more).
UNITSPLN	College units planned (at time of assessment test), on a scale of 1 (1 to 5 units) to 5 (17 or more units).
ENTERING	Fall 1987 entering students (includes first-time new, new transfers, and returning) = 1, continuing students (from Spring 1987 term) = 0.
TRANSGEN	Transfer/general educational goals = 1, all other educational goals (including vocational degree/certificate, job skills, and undecided) = 0.

Intervening Variables - Basic Skills Measures:

WRITSCR	Total English score on the Stanford Test of Academic Skills (TASK) assessment instrument (possible range of 94 points).
WRITPLC	SCC English writing course placement level based on WRITSCR, where: 1 = lower remedial level (non-AA degree applicable). 2 = higher remedial level (non-AA degree applicable). 3 = AA degree applicable level. 4 = transferable level (to UC and CSU systems).
READSCR	Reading score on the TASK assessment test (possible range of 87 points).
READPLC	SCC English reading course placement level based on READSCR, where: 1 = lowest remedial level. 2 = middle remedial level.

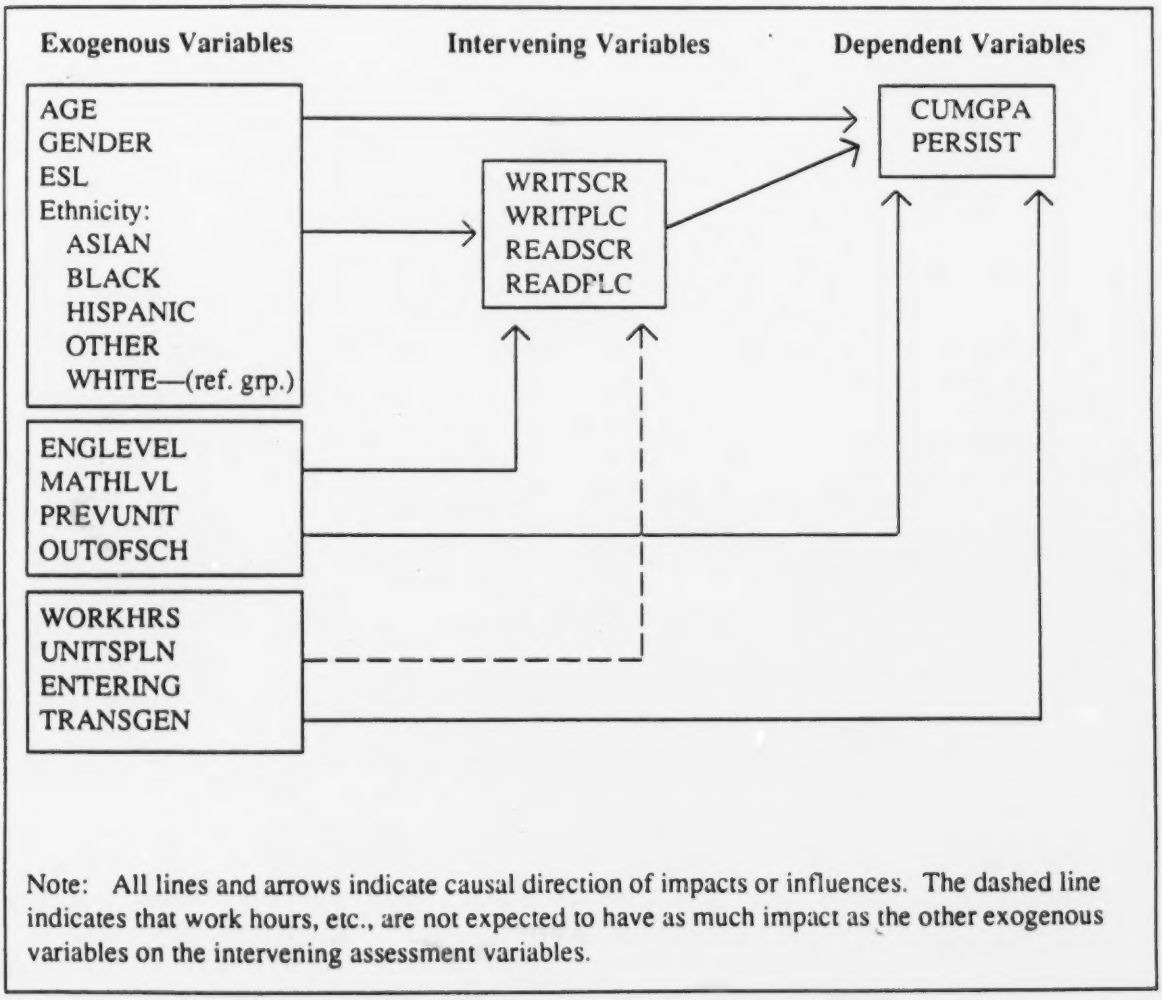
3 = highest remedial level
4 = AA degree applicable level

Dependent Variables—Student Success:

CUMGPA — Cumulative GPA as of last term enrolled from Fall 1987 through Spring 1989 (including Summer 1988 session).

PERSIST — Persistence, as number of semesters enrolled from Fall, 1987 through Spring 1989 (not including Summer 1988 session), on a scale of 0 (dropped out early Fall 1987) to 4 (remained enrolled all four semesters).

The Causal Model



Note: All lines and arrows indicate causal direction of impacts or influences. The dashed line indicates that work hours, etc., are not expected to have as much impact as the other exogenous variables on the intervening assessment variables.

The causal model which is diagrammed on the preceding page provides the theoretical and operational framework for the analysis in this study. Demographic and educational background characteristics are considered to be "exogenous" because they are determined before students enter SCC and are assessed for basic skills in English. All the demographic variables and the first four educational background variables may have a direct effect on students' basic skills in English (as measured by how they perform on the assessment test).

The second set of educational background variables is more problematic in terms of their causal relationships to the intervening variables. WORKHRS and UNITSPLN are not as likely to influence students' basic skills assessment scores as they are to influence their academic success. However, they may be indicators of students' socio-economic status, which in turn may be related to their basic skills preparation or ability to perform well on the assessment test. ENTERING may reflect cohort differences in other variables which may have some impact on the intervening assessment variables. Also, continuing students are more likely to have taken or re-taken the English and reading tests after being enrolled for some time at the college. TRANSGEN may reflect differences in students' academic aspirations and motivations as well as their academic abilities, all of which may affect their assessment test scores.

All of the exogenous variables may have direct effects on students' academic success (as measured by cumulative GPA and persistence) as well as having indirect effects on academic success through the intervening basic skills assessment variables. English and reading scores (WRITSCR and READSCR) on the Stanford Test of Academic Skills (TASK) test, which are used to determine recommended writing and reading course placements (WRITPLC and READPLC) on the basis of cut-off scores, represent students' overall basic skills in the English language. As such, variation in test scores should be partially accounted for by the demographic and educational background variables. In turn, as measures of students' academic preparation and ability--which vary greatly on an individual basis--they should account for a significant amount of variation in the student success variables, CUMGPA and PERSIST, above and beyond what can be explained by the exogenous variables.

Statistical Methods

The major statistical approach used in this study is multiple regression. Its major advantage is that it allows for reasonably accurate estimation of the unique, additive effects of each independent variable while statistically controlling for the effects of the other variables in the causal model. Therefore, the coefficients reported in the section on statistical results are partial, as opposed to bivariate, slopes for the predicted linear effects of the interval scale independent variables on the dependent variable specified in each equation.

With the exception of ethnicity, all categorical variables are coded as dichotomous dummy variables to allow for their use in the regression equations. The coefficent for each of these variables should be interpreted as a shift in the constant or intercept term which measures the average difference in the dependent variable between the two categories of the variable in

question. The four ethnicity dummy variables were entered as a separate block in all equations to test for their collective significance (change in R^2) as well as significant differences between each minority group and whites (the reference group) which are indicated by their individual coefficients.

Structural and reduced form equations were specified for both the intervening and the dependent variables. These allow for quantitative estimates of the direct and indirect effects of the independent variables, which are indicated by the causal path arrows in the model on page 5.

Limitations of the Study

The sample size and availability of data for this study placed a number of limits on how these questions could be operationalized, and the results of the statistical analyses reported in this paper must be considered as preliminary until additional data and research confirms or disconfirms them. A 10% sample of the total student population in Fall 1987 was selected because much of the data for this study had to gathered and entered by hand from individual student transcripts and assessment records. As noted above, only 585 of the original 1381 in the sample had assessment scores for reading and writing. Assessment math scores were not examined as a variable in this study because very few students in this Fall 1987 sample had been assessed for basic math skills. As matriculation is implemented, beginning with the Fall 1988 cohort of first-time new students, many more students are now being tested for basic math skills, and this will allow for inclusion of math scores and placement levels in subsequent studies.

It is important to note that the 585 students in the sample with writing and reading assessment scores are not proportionally representative of the larger sample or the student population as a whole in terms of their demographic characteristics, educational goals, and student classification. Younger students (twenty and under) are over-represented and older students are correspondingly under-represented among those assessed. First-time new and continuing students are over-represented, and new transfer and returning students are under-represented. Males and Asians, blacks, and Hispanics are somewhat over-represented, whereas females and whites are somewhat under-represented. Students with transfer or general education goals are over-represented and those with job skill educational goals or no educational goal are under-represented among those assessed. Because some student groups are better represented among those assessed than others, the findings of this study can be more reliably generalized to the assessed student population than to the student population as a whole.

Other limitations of this study stem from the way in which the dependent or outcome variables and some of the independent variables were measured and operationalized. Beginning with the dependent variables, this study focuses on two general measures of student performance or success, both of which pose some problems in terms of their reliability and their content validity. Cumulative GPA is an aggregate measure of students' performance in a variable number of courses over a variable number of semesters. For the continuing, returning, and new transfer students in the study sample, this measure may encompass grades from semesters previous to Fall

1987, and even for first-time new students, it may encompass course grades over a varying number of semesters, depending on how long they persisted as students from Fall 1987 through Spring 1989.

Because students are likely to acquire additional study skills and other academic survival strategies as they persist in college, the strength of the relationship between their previous educational background and basic skills assessment results and their cumulative academic performance as measured by GPA are likely to decline over time. The individual grades that make up students' cumulative GPA also reflect a great deal of variation in instructors' grading patterns and students' programs of study. Since these factors are not addressed in this study, they represent sources of measurement error and unexplained variation in this dependent variable. Grades and grade point averages may be problematic measures of students' learning and academic abilities for more fundamental reasons as well. Very little research has been conducted on how well grades reflect students' capacity for critical grasp of key concepts, their long-term retention of acquired knowledge and skills, or the capacity to utilize them on their own in the workplace or in their daily lives. Although students learn to study for the grade, the best measure of their academic success may be whether or not they attain the educational goal that brought them to the college. Data on this success measure were not available for this study.

The other dependent variable, persistence, is measured as the number of semesters from Fall 1987 through Spring 1989 that students stayed enrolled at SCC long enough to have a transcript notation. The Summer 1988 session was not included in this measure because many otherwise persisting students do not choose to enroll in summer classes. This measure is fairly straightforward, and it has the advantage of allowing for some intermittent attendance. For example, a student who attended Fall 1987 and Spring 1988 and then left SCC and another student who attended in Fall 1987 and in Fall 1988 but neither of the two spring terms would both have a score of two for persistence.

As with cumulative GPA, the more a student persists, the less strongly it may be related to his or her previous (especially pre-collegiate) educational background. Also, persistence per se does not measure how well the student is succeeding beyond the minimal performance required to stay enrolled at the college. Another limitation is that some students (especially those who were continuing students as of Fall 1987) could attain their educational goals and leave SCC within the Fall 1987 to Spring 1989 time frame.

In addition to the examination of inter-semester persistence, the study sample population was followed over the two year period in an attempt to gather large enough sub-samples of students who had enrolled in a number of basic skills and content courses to be able to evaluate the predictive validity of assessment measures in terms of success in specific courses. Unfortunately, the size of the sub-samples of students with the appropriate data proved to be too small for most of the courses to permit statistical tests for significant relationships between these variables. With a few exceptions, course sub-sample sizes of less than 100 did not provide useful results, and the extent to which the results can be reliably generalized to the larger population is somewhat questionable even for those courses where the results proved to be statistically

significant. For this reason, course-level success measures are not addressed in this report.

Turning to the independent variables, most of the demographic and educational background data are self-reported on admission applications and assessment forms and not verified with high school transcripts. This introduces the possibility of considerable measurement error, which limits the reliability of the data, especially for such variables as previous English and math levels completed, since the wording on the assessment form leaves some room for different interpretations. In addition, although the variables PREVUNIT, OUTOFSCH, WORKHRS, and UNITSPLN are treated as interval scale variables (i.e., with equally spaced units of measurement), they are, in fact, ordinal scale variables with unequally grouped categories. In the case of PREVUNIT, which has eight categories which are functionally meaningful in terms of completed college work and current standing, this does not pose a major problem. OUTOFSCH, on the other hand, has only three categories, which convey limited information. Also, it is not clear from the wording of the question, "How long have you been out of school?", whether this refers to high school or college or some other educational institution. The measurement errors introduced by these factors are more likely to suppress than the exaggerate the true relationships between the variables which are examined in this study. In addition, WORKHRS and UNITSPLN may not be stable enough as variables to reliably measure their possible effects on student success over the two year time frame of the research design.

The assessment test scores for writing and reading are no doubt reliable in terms of reporting students' actual scores. However, the date on which students were assessed could not be controlled for in this study design; and some of the scores represent students' best performance after repeating the test (based on how the assessment database was maintained before SCC acquired the CAPP System in 1989). These factors could blur the statistical relationships between assessment scores and other variables.

The fundamental issues of content validity, cultural or linguistic bias, and stability of assessment test results over time cannot be adequately addressed in the framework of this study. The California Community College Chancellor's Office is placing the responsibility for addressing these issues on commercial test developers. Issues such as the fair use and predictive validity of assessment tests as they are used by colleges to advise and place students in the college curriculum are very much the responsibility of individual colleges to address, as is the development of multiple assessment criteria. This study does not directly address the validity of current cut-off scores for placing student in basic skills courses, nor does it address how well assessment scores and recommended placment levels predict success in specific content courses (for reasons cited above). However, it does address the research questions and concerns which are raised in the Introduction and provides preliminary findings which should set the stage for further research into these challenging issues.

Multiple Regression Results

The Effects of Demographic and Educational Background Variables on Writing and Reading Score

English writing scores and reading scores on TASK assessment tests were regressed on the demographic and educational background variables to determine which, if any, of these variables had a statistically significant effect on test scores. The first equation in Tables 1 and 2 (for writing and reading score, respectively) examines the effect of age, gender, ESL, and ethnicity on writing and reading scores, without controlling for the educational background variables. The second equation (Eq. 2) includes and controls for the effects the first block of educational background variables, ENGLEVEL, MATHLVL, PREVUNIT and OUTOFSCH, in addition to the demographic variables. The third equation (Eq. 3) also includes the second block of educational background variables, WORKHRS, UNITSPLN, ENTERING, and TRANSGEN. The first two equations are "reduced form" equations because they do not include all the independent variables. The third equations in Tables 1 and 2 look at the effect of all the demographic and the educational background variables, while controlling for spurious effects among them. These are the complete or "structural equations" for writing and reading scores.

Looking first at the effects of the demographic variables on writing scores (Eq. 1, Table 1), gender, ESL, and ethnicity are significant and age is not. Females score an average of 3.0 points higher on the writing test than males. Those students for whom English is a second (non-native) language score an average of 12.0 points lower on the writing test than do those for who English is the native language. The collective effect of the ethnicity categories accounts for 5.1% of the variation in writing scores. In comparison to whites (the reference group), black students on average score 8.4 points lower on the writing test, and students in the "other" category score 7.7 points lower. The demographic variables together account for a considerable 16.5% of the variance in writing scores.

When the first block of educational background variables are added (Equation 2, Table 1), English level completed and previous math level completed at the time of assessment both have a significant impact on writing scores, whereas previous units completed and years out of school do not. Specifically, for each additional level of English completed, students score an average of 2.7 points higher on the writing test. For each additional level of math completed, students also score an average of 2.6 points higher. The effects of the demographic variables remain relatively close to what they were in Equation 1. The average difference between female and male scores increases by one point, indicating that females complete somewhat less English or math before assessment than males. The amount of variation in writing scores explained collectively by ethnicity declines to 3.3%, suggesting that some of the effect of ethnicity operates indirectly through English and/or math level completed. The total amount of explained variance in writing scores (R^2) roughly doubles from Equation 1 (16.5%) to Equation 2 (32.2%), indicating that educational background has a fairly strong effect on students' English writing skills.

Table 1:
Regression Coefficents for WRITSCR on Demographic and Educational Background Variables: Reduced Form and Structural Equations

Demographic Variables:	Eq.1	Eq.2	Eq.3
AGE	-.148	.064	.068
GENDER	2.970*	3.994*	4.072*
ESL	-12.000*	-12.368*	-7.307*
Ethnicity (R^2 change)	(.051)*	(.033)*	(.029)*
ASIAN	.145	-3.295	-3.096
BLACK	-8.395*	-7.008*	-6.740*
HISPANIC	-3.817	-2.830	-3.152
OTHER	-7.689*	-7.495*	-6.997*
Educ. Bkgrd. Variables			
ENGLEVEL		2.731*	2.827*
MATHLVL		2.608*	2.576*
PREVUNIT		.608	.834
OUTOFSCH		-1.536	-1.608
WORKHRS			.749
UNITSPLN			-.306
ENTERING			2.746*
TRANSGEN			.871
Constant	72.825	54.736	51.016
R^2	.165*	.322*	.336*

* Significant at the .05 level.

N = 400

Table 2:
Regression Coefficents for READSCR on Demographic and Educational Background Variables: Reduced Form and Structural Equations

Demographic Variables:	Eq.1	Eq.2	Eq.3
AGE	.028	.124	.121
GENDER	-.314	.619	.676
ESL	-13.116*	-13.657*	-13.038*
Ethnicity (R^2 change)	(.078)*	(.084)*	(.078)*
ASIAN	-7.522*	-10.421*	-10.266*
BLACK	-10.392*	-9.165*	-9.037*
HISPANIC	-3.356	-2.526	-2.727
OTHER	-7.069*	-6.496*	-6.219*
Educ. Bkgrd. Variables			
ENGLEVEL		1.805*	1.874*
MATHLVL		2.376*	2.356*
PREVUNIT		.138	.298
OUTOFSCH		.226	.172
WORKHRS			.570
UNITSPLN			-.094
ENTERING			2.028
TRANSGEN			.072
Constant	74.432	60.047	57.428
R^2	.294*	.386*	.394*

* Significant at the .05 level.

N = 400

Adding the second block of educational background variables in Equation 3 (Table 1) increases the R^2 very little, and only ENTERING has a significant impact on writing score. On average, Fall 1987 entering students' writing scores were 2.7 points higher than those for continuing students. The coefficients for the previous exogenous variables remain fairly constant, with the exception of the ESL coefficient, which declines in absolute value to -7.3 in Equation 3. This suggests that there may be a higher proportion of English non-native students who were assessed among the continuing student cohort than among the entering student cohort.

Equation 1 in Table 2 shows the effects of the demographic variables on reading scores. ESL and ethnicity have significant effects on reading scores, but gender and age do not. English non-native students score an average of 13.1 points lower on the reading test than other students. Ethnicity collectively accounts for 7.8 percent of the variation in reading scores. Asians score an average of 7.5 points lower, blacks an average of 10.4 points lower, and those in the "other" category 7.1 points lower than whites on the reading test. The demographic variables together explain a remarkable 29.4% of the total variance in reading scores, and their relationships to reading score remain very similar after both blocks of educational background variables are added to the regression (in Equations 2 and 3, Table 2). Perhaps the only notable exception is that Asians score an average of 10.3 points lower than whites when educational background is taken into account.

Among all the educational background variables, only ENGLEVEL and MATHLVL have statistically significant effects on reading score. For each additional level of English completed at the time of assessment, students score on average 1.8 points higher on their reading test. For each additional level of math completed, students score an average of 2.4 points higher. None of the variables in the second block of educational background variables have significant influences on reading score, and they add very little to the R^2.

Although all the exogenous variables together explain more of the variation in reading scores (39.4%) than in writing scores (33.6%), the educational background variables account for less of the variation in reading scores (10.0%) than in writing scores (17.1%). Females score significantly higher on the writing test, but there is no significant difference between male and female reading scores. ESL and ethnicity explain more of the variation in reading than in writing scores. Blacks and "other" ethnic students score significantly lower than whites on both assessment tests, whereas Asians score significantly lower than whites only on the reading test. (Although Hispanics score about three points lower than whites on both tests, these differences are not statistically significant.)

In considering these differences in the causal relationships for the writing versus the reading test, it is important to note that the TASK English test that is used as a basis for recommending writing course placements actually requires no writing of students. Rather, it tests students' English spelling and grammatical skills; where as the reading test measures students' English vocabulary and reading comprehension skills. From the above statistical results we may conclude that Asian students' spelling and grammatical skills in English are comparable to those of white students, but their vocabulary and reading comprehension skills are significantly lower.

The Effects of Demographic and Educational Background Variables and Writing and Reading Scores on Cumulative GPA

This phase of the analysis treats cumulative GPA as an outcome or dependent variable which measures, however imperfectly, overall student success. Writing and reading scores, as measures of students' basic skills, are now treated as intervening independent variables. That is, they are both influenced by exogenous demographic and educational background variables and, in turn, affect or "predict" to some degree the outcome variable, cumulative GPA. It is important to note that test scores, per se, do not in themselves affect students' cumulative GPA's, but rather students' basic skills in English writing and reading--as measured by test scores--influence their academic performance--as measured by cumulative GPA.

In Table 3 on the following page, Equation 1 is a "reduced form" equation which indicates the total affect of each of the demographic and educational background variables on cumulative GPA, controlling for spurious effects of the other exogenous variables but not taking the intervening variables--writing and reading score--into account. Equation 2 is the "structural equation" which includes writing and reading score as an intervening variable and looks at the remaining direct effects of the exogenous variables on cumulative GPA once the intervening variables are accounted for. The difference between the regression coefficient in Equation 1 and the coefficient in Equation 2 for the same exogenous variable is a measure of its indirect effect on cumulative GPA through the intervening variables in Equation 2 (i.e., total effects minus direct effects equal indirect effects).

Age, English and math levels completed at time of assessment, previous units or degrees completed at time of admission, and being an entering versus continuing student have significant total effects on students' cumulative GPA. Although the total collective effect of ethnicity does not contribute significantly to the explained variation in cumulative GPA (only 1.7%), black students' GPA is, on average, significantly lower GPA than white students GPA by .387 grade points and lower, on average, than Asian students' GPA by .553 grades points. For each additional year of age, students' cumulative GPA is on average .029 points higher or .29 points higher for every additional ten years of age. Students with one additional level of English completed at the time they were assessed average .136 point higher on their cumulative GPA. For each addition level of math completed, students average .113 points higher on GPA; and for each increase of one unit on the eight-point PREVUNIT scale, GPA is an average of .110 points higher. Finally, Fall 1987 entering students' cumulative GPA over the two year period of this study is an average of .318 points lower than Fall 1987 continuing students.

Considering that the mean GPA for the 400 cases included in the regression equation is 2.190, the difference between entering and continuing students' GPA is significant. It appears that students who are able to persist over a number of semesters gradually raise their GPA's, since continuing students had a head start on entering students in terms of persistence.

Table 3:
Regression Coefficients for CUMGPA on the Demographic and Educational Background Variables, WRITSCR and READSCR

Demographic Variables:	Eq.1	Eq.2
AGE	.029*	.027*
GENDER	.021	-.040
ESL	-.131	-.163
Ethnicity (R^2 change)	(.017)	(.013)
ASIAN	.166	.318*
BLACK	-.387*	-.200
HISPANIC	.037	.035
OTHER	-.020	.140
Educ. Bkgrd. Variables		
ENGLEVEL	.136*	.078
MATHLVL	.113*	.053
PREVUNIT	.110*	.095*
OUTOFSCH	.070	.090
WORKHRS	-.020	-.036
UNITSPLN	.022	.027
ENTERING	-.318*	-.377*
TRANSGEN	.119	.106
Assessment Variable		
WRITSCR		.013*
READSCR		.011
Constant	.523	-.779
R^2	.231*	.284*

* Significant at the .05 level.

N = 400

The demographic and educational background variables account for 23.1% of the variation in cumulative GPA. When the intervening variables, WRITSCR and READSCR, are added to the regression equation (Equation 2, Table 3), the amount of explained variation in cumulative GPA increases by 5.3% to 28.4%. The coefficients for age and previous units remain fairly constant and statistically significant, indicating that for the most part they affect cumulative GPA directly. The coefficient for ENTERING becomes somewhat more negative (-.377), indicating that entering students have an even lower GPA than continuing students when the positive effect of their higher average English score (WRITSCR) is taken into account.

When assessment scores are controlled for, the coefficient for the average difference between black students' and whites students' GPA becomes less negative and no longer statistically significant. On the other hand the coefficient for the average difference between Asian students' and white students' GPA becomes more positive and statistically significant. In both cases, this is due to the fact that blacks and Asians had lower assessment scores than whites, especially on the reading test, as was found in the previous section. From the differences in their average GPA relative to white students, it would appear that Asian students are more likely than black students to compensate for their lower proficiency in English skills with other cultural, socioeconomic, or academic factors not measured in this study.

With writing score and reading score in the equation, the coefficients for previous English level and math level completed both decrease to about half their magnitude in the reduced form equation and are no longer statistically significant. This indicates that about half of the effect of each of these variables operates directly on cumulative GPA and the other half operates indirectly through writing and reading scores. This is borne out by the fact the English and math level completed were found to have significant impacts on the assessment test scores.

For each additional point that students scored on the writing test, their cumulative GPA is an average of .013 points higher, and for each additional point on the reading test, students' GPA is .011 points higher. Yet the slope for writing score is statistically significant and that for reading score is not. This may partially reflect the fact that reading score is more highly associated with the exogenous variables than writing score. Reading score is also highly correlated with writing score (the bivariate correlation between the two tests scores is .755). The tolerances for the two test scores in the same regression are also low enough (.319 for reading score and .350 for writing score) to indicate a problem of multicollinearity.

Because the two intervening variables are so highly correlated with each other, they were entered in separate structural equations in Table 4 on the next page to better estimate their effects on cumulative GPA. When taken separately, the coefficients for writing score (in Equation 1) and for reading score (in Equation 2) are both larger in magnitude and statistically significant at the .05 level. For each increase of one point on the writing score, cumulative GPA is an average of .020 points higher. For each increase of one point in reading score, cumulative GPA is an average of .021 points higher. The R^2 value does not appear to decrease appreciably for either of the two equations, indicating that the regression with one of the test scores explains almost as much of the variation in GPA as the regression with both of them together.

Table 4:
Regression Coefficients for CUMGPA on the Demographic and Educational Background Variables and WRITSCR or READSCR

Demographic Variables:	Eq.1	Eq.2
AGE	.028*	.026*
GENDER	.061	.007
ESL	.100	.142
Ethnicity (R^2 change)	(.011)	(.016)
ASIAN	.228	.381*
BLACK	-.251	-.198
HISPANIC	.029	.020
OTHER	.121	.110
Educ. Bkgrd. Variables		
ENGLEVEL	.080	.097
MATHLVL	.061	.066
PREVUNIT	.093*	.103*
OUTOFSCH	.103	.069
WORKHRS	-.035	-.032
UNITSPLN	.028	.024
ENTERING	-.373*	-.360*
TRANSGEN	.101	.117
Assessment Variable		
WRITSCR	.020*	
READSCR		.021*
Constant	-.504	-.678
R^2	.278*	.273*

* Significant at the .05 level.

N = 400

The Effects of Demographic and Educational Background Variables and Writing and Reading Placement Levels on Cumulative GPA

Course placement levels based on cut-off scores for the writing and reading assessment tests, rather than raw scores per se, are used in actual counseling and placement practices at SCC. Therefore, these variables (WRITPLC and READPLC) were examined as intervening variables in lieu of writing and reading scores in separate regression equations to examine whether they also significantly predicted differences in cumulative GPA. These regression results are reported in Table 5 on the following page. Writing and reading placement levels, like writing and reading test scores, have significant impacts on cumulative GPA. The coefficient for writing placement in Equation 1 indicates that for each increase of one writing course level, cumulative GPA increases an average of .169 points. The coefficient for reading placement in Equation 2 indicates that for each increase of one reading course level, cumulative GPA increases an average of .275 grade points.

The effects of the other variables on cumulative GPA with WRITPLC or READPLC in the equation are very similar to what they are for the equations with WRITSCR or READSCR as intervening variables (Table 4), with the exception that English level also has a significant effect on cumulative GPA. For each additional level of English completed, cumulative GPA is an average of .114 grade points with WRITPLC as the intervening variable and an average of .121 grade points with READPLC as the intervening variable.

Table 5:
Regression Coefficients for CUMGPA on the Demographic and Educational Background Variables and WRITPLC or READPLC

Demographic Variables:	Eq.1	Eq.2
AGE	.023*	.024*
GENDER	-.038	-.022
ESL	.022	.013
Ethnicity (R^2 change)	(.014)	(.014)
ASIAN	.265	.308
BLACK	-.280	-.247
HISPANIC	.015	-.016
OTHER	.105	.094
Educ. Bkgrd. Variables		
ENGLEVEL	.114*	.121*
MATHLVL	.074	.077
PREVUNIT	.103*	.106*
OUTOFSCH	.119	.104
WORKHRS	-.023	-.027
UNITSPLN	.027	.029
ENTERING	-.355*	-.370*
TRANSGEN	.078	.088
Assessment Variable		
WRITPLC	.169*	
READPLC		.254*
Constant	.311	-.168
R^2	.269*	.275*

* Significant at the .05 level.

N = 400

The Effects of Demographic and Educational Background Variables, WRITSCR and READSCR on PERSIST

Table 6 on the next page shows the results for the regression of the outcome variable PERSIST on the exogenous variables and the intervening variables, WRITSCR and READSCR. In both the reduced form equation (1) and the structural equation (2), only previous English level completed and the difference between Asians and whites are significant. In terms of its total effect, for each additional level of English completed, students persist an average .190 semesters longer. The coefficient declines slightly in Equation 2, but most of the effects of English level completed on persistence are direct. Asian students persist on average about one half of a semester longer than white students. Neither writing or reading score have a significant effect on persistence, and all the variables together explain less than 10% of the variation in persistence. The weakness of the causal relationships specified in the regression equations may reflect more on the adequacy of persistence as a student success variable, at least within the limitations of the study design.

Table 6:
Regression Coefficients for PERSIST on Demographic and Educational Background Variables, WRITSCR and READSCR

Demographic Variables:	Eq.1	Eq.2
AGE	-.002	-.003
GENDER	.051	.027
ESL	-.137	.001
Ethnicity (R^2 change)	(.022)	(.022)
ASIAN	.423*	.503*
BLACK	-.286	-.195
HISPANIC	.199	.234
OTHER	-.132	-.057
Educ. Bkgrd. Variables		
ENGLEVEL	.190*	.163*
MATHLVL	-.014	-.042
PREVUNIT	.017	.010
OUTOFSCH	.064	.072
WORKHRS	.019	.010
UNITSPLN	.055	.058
ENTERING	-.176	-.205
TRANSGEN	-.040	-.049
Assessment Variable		
WRITSCR		.005
READSCR		.006
Constant	1.855	1.228
R^2	.082*	.092*

* Significant at the .05 level

N = 399

Summary of Findings

Based on the statistical results of the multiple regression analysis reported in the previous section, the following conclusions can be made about the variables in the study. It is important to note that the impacts of each variable described below hold true regardless of the category or value of the other variables because multiple regression controls for such variation.

- AGE

  Age is a significant predictor of cumulative GPA but not of scores on the Stanford Test of Academic Skills (TASK) English or reading tests. Older students, on average, have higher GPA's.

- GENDER

  Being female is a significant predictor of higher English test scores. Gender does not appear to be significantly associated with reading score, cumulative GPA, or persistence.

- ENGLISH NON-NATIVE

  Being a non-native English speaker is a strongly significant predictor of lower English and reading scores on the TASK. (Many of the English non-native students who took the TASK tests are probably from bilingual families where another language is predominantly spoken at home.) There is no significant difference between being an English non-native and cumulative GPA or persistence.

- ETHNICITY

  English and reading scores vary significantly between ethnic groups. Asian students, on average, score significantly lower on the reading test than white students, but there is no significant difference between their English scores. Black students and students in the "other" ethnic category, on average, score significantly lower than white students on the English and reading tests. There are no significant differences, on average, between Hispanic students' and white students' English or reading scores (although based on the above findings for the English non-native variable, Hispanics who are non-native English speakers score significantly lower than those who are native English speakers).

  Cumulative GPA and persistence vary significantly between ethnic groups. Black students as a whole have significantly lower average GPA than white students, but black students whose English and reading scores are comparable to those of white students do not have a significantly different GPA. The average GPA of Asian students as a whole is not significantly different from that of white students, but Asian students whose English

and reading scores are comparable to those of white students have a significantly higher GPA. Asian students as a whole have a significantly higher persistence rate than white students. There are no significant differences between the average cumulative GPA or persistence rate of Hispanic or "Other" students and those of white students.

- ENGLISH LEVEL COMPLETED and MATH LEVEL COMPLETED

English and math course levels completed are significant predictors of English and reading scores and of cumulative GPA. English course level also positively predicts persistence. For example, students who have completed high school college prep English prior to enrolling at SCC score significantly higher on the English and reading tests and, in turn, have a significantly higher cumulative GPA and persistence rate than students who have completed only high school basic skills or regular English courses.

- PREVIOUS UNITS/DEGREES and TIME OUT OF SCHOOL

College units (or degrees) previously completed is a significant predictor of cumulative GPA but not of assessment scores. Time out of school is not significantly associated with assessment scores or the student success measures. (This may be due to limitations in the way it is measured).

- WORK HOURS and UNITS PLANNED

Students' employment hours and units planned are not significantly associated with assessment scores or student success. (This could be due to limitations in the research design.)

- ENTERING V. CONTINUING STATUS and TRANSFER/GENERAL V. OTHER EDUCATIONAL GOAL

English scores on the TASK were significantly higher for the Fall 1987 entering student cohort than for Fall 1987 continuing students at the time they were tested. However, the average cumulative GPA of entering students is lower than that of continuing students. There are no significant differences between assessment scores and student success measures for students with transfer or general educational goals and those for students with other (primarily vocational and job skill) educational goals.

- ENGLISH AND READING SCORES (and RECOMMENDED PLACEMENT LEVELS)

TASK English and reading test scores and recommended placement levels are significant predictors of cumulative GPA but not of persistence. English and reading scores are very highly correlated with each other.

Discussion

There are several practical implications for institutional policies and practices which can be drawn from the findings presented above. Matriculation regulations require community colleges to evaluate how well assessment instruments and other assessment and placement criteria predict success in basic skill and discipline-specific courses. Several variables included in this study are significant predictors of student success and can be used as multiple criteria for assessment and counseling/advisement or otherwise taken into account by SCC staff.

Because they are highly correlated with each other, TASK English and reading scores should be utilized together as one assessment and placement criterion. Although recommended placement levels based on current cut-off scores work about as well as raw test scores for predicting cumulative GPA, they still need to be validated by the college as predictors of success in writing and reading courses. When there are major discrepancies between students' English and reading test scores, students should meet individually with a counselor for a more in-depth discussion and evaluation.

Previous English and math course levels completed can serve as multiple criteria along with assessment test scores or recommended placement levels. In addition to these two educational background variables, high school GPA, grade in last English class and grade in last math class, which are available from the Computerized Assessment and Placement Program (CAPP) database, should also be examined as other possible assessment and placement criteria. Perhaps high school transcripts should be obtained to confirm the reliability of students' self-reports on the CAPP form. Beginning in Fall 1988, many more students at SCC were tested for math skills, and math scores and recommended math placement levels should also be examined as possible multiple assessment and placement criteria, particulary for math courses.

Although age is not a significant predictor of students' performance on the TASK assessment tests for writing and reading skills, it is a significant predictor of success as measured by GPA. This implies that older students may have experience, skills and motivation that younger students may not have but which are not adequately measured by the assessment instrument. Therefore, students' age may be useful to take into account along with the factors identified above.

Previous college units/degrees positively predicts general student success as measured by cumulative GPA, but this variable is currently used as a matriculation exemption criterion at SCC. As such, it would not be relevant as one of the college's multiple criteria, except for matriculation-exempt students who voluntarily choose to be assessed.

Even controlling statistically for all the other variables included in this study, there are significant differences between specific ethnic groups in terms of their average assessment test scores, cumulative GPA's, and persistence rates. Until the TASK and other tests are carefully evaluated for cultural and linguistic bias and approved by the CCC Chancellor's Office as meeting minimal standards in this regard, there is no way to know how much the differences in test scores between

ethnic groups reported in the findings are due to test bias and how much they are due to differences in basic skills in English, learning and study skills, academic motivation, or socio-economic factors not accounted for in this study. Community college educators need to bring pressure to bear on test developers to do their part in this evaluation. In the meantime, careful test orientation for students by the Assessment Center staff as well as multiple criteria assessment within the counseling process can countervail possible cultural, linguistic, or other biases in the assessment instrument.

A fair number of Fall 1987 students who said English was not their native language (N = 133) took the TASK writing and reading tests, and they scored significantly lower, on average, on these tests. This may indicate that ESL testing and placement in ESL courses would be more appropriate for some of these students, but it may also indicate that a fair number of bilingual students who speak predominantly another language in their homes need basic skills instruction in English and reading. Currently, students who score low on the TASK and indicate that English is not their native language are directed to take the ESL test. Bilingual students should also receive individual placement counseling which takes other criteria and factors into account.

Students' responses to the questions on the assessment form which ask about their employment hours and college units planned are most likely specific to the time at which they were assessed and the school term immediately ahead of them. The work hours and college units which students plan for themselves are very likely to change over time, and even if they did not, the relationship between these factors and their cumulative GPA is very likely to attenuate as the number of semesters over which their cumulative GPA is measured increases. It is more likely that a relationship would be found between Fall 1987 entering students' work hours or units planned and their Fall 1987 GPA's than their cumulative GPA's. This semester-specific measure of student success should be examined in subsequent work on this project or future research projects at SCC.

Based on the findings, entering students must be considered a more "at risk" group than continuing students regardless of their assessment test scores. Motivation, self-discipline, and learning/study skills, as well as basic skills preparation, can strongly influence students' academic survival and success. SCC can enhance all these factors through appropriate student services and instructional interventions, such as the Early Start Program (ESP), Educational Opportunity Programs and Services (EOPS), "College Success" extended orientation course, the Higher Education Learning Package (HELP), and the Puente Project, whereas many of the demographic and educational background variables in this study are outside of the college's immediate control to address.

Persistence was not significantly related to the demographic, educational background, or basic skills assessment variables, with the few exceptions noted in the above findings. Persistence may not be a very useful or valid measure of student success without taking educational goal, student classification, and other factors into account. Students who enter SCC with a large number of college units or previous degrees may attain their educational goal well within the four semester period for which persistence was measured in this study, especially if they are attending primarily

to obtain or upgrade specific job skills. In addition, many students with job and family responsibilities may purposely attend SCC on an intermittent as well as a part-time basis.

Suggestions for Further Research

Although this study was initially undertaken as part of the Assessment Center's on-going institutional program review process, it also provides pre-matriculation "baseline" data and statistical results for SCC's overall Matriculation Research and Evaluation Plan and especially for the Assessment component, which has received so much emphasis from the Chancellor's Office and in the Matriculation Regulations adopted by the Board of Governors of the California Community College system. The Matriculation Regulations which become effective July 6, 1990, require community colleges to utilize valid and reliable multiple criteria for assessment and placement and to "determine whether any assessment instrument, method or procedure has a disproportionate impact on particular groups of students described in term of ethnicity, gender, age, or disability, as defined by the Chancellor" (Section 55512 [b]).

Based on an exploratory study of six California community colleges which addressed the issue of whether assessment and placement practices pose barriers to access for underrepresented minorities, Kanter (1990) concluded that "emphasis should be placed on assisting underrepresented students to become eligible in greater numbers for the transfer/baccalaureate level of community college courses. If socioeconomic or income rather than ethnicity data had been available for this study, it is likely that these variables would have emerged as the strongest predictors" of placement at the precollegiate basic skills, associate degree applicable or transfer/baccalaureate level. Further SCC research on predictors of students' basic skills and academic success should include income and other socio-economic variables if it is possible to obtain data for them.

The greatest need for further assessment research at SCC at this time is to develop a database with adequate course-level sample sizes to permit evaluation of the relationship between demographic and educational background characteristics, assessment test scores and recommended placement levels, and course-specific success measures (grades and successful completion) for both basic skill and content courses. At the college level, this requires working back from course enrollment lists to admissions and assessment records and forward to transcripts for end-of-semester grades. The sampling design should include students who enroll in the selected courses not more than two semesters after they enter the college and are assessed for basic skills. One study design that uses this approach is Design 6, "History Course Success Based on English Eligibility," Matriculations Local Research Options Project (Spicer, 1989). By adding additional student demographic and educational background data and elaborating the design to include a range of courses across the college curriculum rather than one particular course, such a study would address a number of Matriculation research and evaluation issues and aid in validating pre- and co-requisites for college courses, as required by Title V regulations.

Perhaps the most important study to date along these lines involved a consortium of southern California colleges headed by a team of researchers at Santa Barbara City College (Cohen, et. al., 1989). They found the following variables to be the most common best predictors of students' grades across a fairly large number of college courses: English test score, reading test score, math test score (or math level), high school GPA, age, units planned, number of hours employed, and high school graduation status. As is noted in the report, "Colleges need to identify their own set of predictor variables based on information they collect from students" (p. 15). The Assessment Center has been gathering data on these and other variables with the new CAPP system since December 1988, and this will allow the Office of Planning, Research and Development to identify SCC's own set of best predictors of student success.

In addition to investigating students' basic skills in writing, reading, and math as measured by assessment test scores, research on predictors of student success should take students' motivation and study skills into account. Kochenderfer (1988) conducted an exemplary study at Riverside Community College to examine the effect of these factors on academic success. Using multiple regression techniques, she found that Learning and Study Strategies Inventory (LASSI) scores (on all ten sub-scales) explained more of the variation in student success as measured by GPA than did basic skills test scores. Further, the LASSI motivation scale accounted for more variation in GPA than the other scales combined. Kochenderfer notes, "The study indicates that the addition of a learning and study strategies measure to the community college entrance examination could more than double the predictive validity of the assessment." The Counseling Division may wish to incorporate use of the LASSI into SCC's matriculation assessment process on a pilot basis and add LASSI scores to the CAPP system. Research could then be conducted to evaluate the LASSI's predictive validity as another criterion for assessment and placement purposes.

The ultimate purpose of this study and all future research on assessment and student success is to provide information regarding the effectiveness of SCC's on-going efforts to increase the prospects of success for its highly diverse student population. By identifying factors which contribute to students' academic success as well as those which may put them at risk of non-success, institutional research can contribute substantially to the college's mission of making open access the "right to succeed" for every student who attends.

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